For discussion purposes only
Not a final recommendation of NENA or any other 9-1-1 authority
Submitted in WC Docket 04-36 pursuant to Section 1.1206 of the Rules

TRANSITIONAL ("I2") VOIP DELIVERY OF E9-1-1

Ideally, all investment toward improved enhanced 9-1-1 service ("E9-1-1") access would be directed to immediate completion of an IP-based Next Generation ("NG") 9-1-1 capability on a national scale. In reality, with best efforts of all involved, it will take three or more years implement the NENA "I3" or any other next-generation solution.

But the future is always "now" in terms of how we get there. An intermediate transitional approach is needed. NENA has designed a migratory ("I2") plan that reflects NENA's collaborative efforts for the next generation solution, known as "I3.". The goal during the I2 period is to allow at least fixed and "nomadic" VOIP calls to 9-1-1 to provide Automatic Number Identification ("ANI") and Automatic Location Information ("ALI"). These features permit the call to be routed to an appropriate Public Safety Answering Point ("PSAP"), and give to the PSAP the caller's location and callback number.

There are a variety of means to provide interim VOIP 9-1-1 service on the Public Switched Telephone Network ("PSTN") as it is now configured. Some VOIP providers are using these methods. Unfortunately, the vast majority of 9-1-1 calls originating with VOIP providers are below even the basic level of service for wireline calls over the past two decades or more. These VOIP calls reach a PSAP on a 10-digit number outside the "native" 9-1-1 (abbreviated-dial/Selective Router) network.

The information below is intended to help the FCC and interested parties decide whether the variety of possible interim approaches should coexist during this period of transition, or whether it would be better to encourage the narrowing of options for a more cost-effective and hopefully speedier migration to NG9-1-1.

VOIP Service Classifications

FIXED. This service may only be used at a single point of connection to a residence or business. The limitation may appear in a customer contract, or the means of installing the service may preclude changing the connection point. In this respect, the service resembles conventional wire telephone service.

An example of a fixed VoIP application is the telephone service offered by a cable TV system operator. The customer of the cable TV company who subscribes to Internet access via a cable modem is provided with a VoIP terminal adapter (TA) that connects the customer's standard telephone set to the cable modem router. It is expressly understood that the TA will remain connected at the customer's home location. The customer may either keep its existing telephone number -- via standard local number portability ("LNP") practices -- or be assigned a new telephone number that is valid for the PSTN locale called a "rate center." In this application the customer usually has the same level of 9-1-1 service as over a residence or business line from

the incumbent local exchange carrier ("ILEC") or any certified competitive local exchange carrier ("CLEC").

VOIP providers know the physical location of primary use for this offering, which patterns itself on traditional circuit switched telephony. The majority of suppliers of fixed services are currently certified by their states, and therefore have interconnection agreements with the ILECs supporting 9-1-1 services. Interconnection through direct trunks to the 9-1-1 router and access to the 9-1-1 database management system are standard features of Interconnection Agreements ("ICAs") approved by state regulatory bodies.

Another relevant aspect of the VoIP telephony provided by most cable TV system operators is its dedicated, closed network that does not use the public Internet at all. Such applications may be called Private IP/PSTN because the Internet Protocol is used in the private network and voice telephone calls are handed off to the Public Switched Telephone Network.[1]

Some Fixed VoIP service providers allow customers to use "non-native" telephone numbers not found in the local rate center of the user's address. An example is given in the following section.

NOMADIC. A nomadic user of VOIP service is able to change his point of use to almost any location offering broadband internet access. His portable Terminal Adapter ("TA") allows him to convert analog to digital signals, and vice versa. VOIP service providers more commonly allow customers to use non-native telephone numbers.

The rapid growth in the number of nomadic customers is currently the greatest challenge to 9-1-1. The offering presents new problems in determining the location of the caller and conveying the caller's location and callback number to the PSAP.[2]

The nomadic model separates the application (in this case, voice conversations) from the physical transmission facility. It is indifferent to whether the underlying broadband facility is cable, Digital Subscriber Loop ("DSL"), or even Broadband over Power Line ("BPL"). VOIP providers generally offer on the application and not the transmission facility.

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[1] Of course, many cable operators also provide telephone service that is not IP-based and connects to the PSTN in the conventional manner of other competitive carriers. The two types of service should not be confused.

[2] Today, we believe most services capable of nomadic application are used in a fixed mode. This appears to have been so in the widely-reported failure of a 9-1-1 call by a Houston family taking Vonage service over an Earthlink platform. The incident – a home break-in and non-fatal shooting -- gave rise to debate about whether the customer properly "registered" its location with Vonage or, if not, whether the customer knew or should have known to do so. Such knowledge becomes critical in true nomadic usage, where the customer must play a role in registering a changed location.

The customer uses a TA or a special telephone device that transmits a voice call in digital packets to the service provider's "gateway switch" via the internet. The ubiquity of the internet medium and the independence of the VOIP application from its broadband transmission make nomadic service attractive to subscribers who wish to have non-native telephone numbers. For example, a movie production company with offices in Los Angeles wants to cultivate a client base in New York. The business contracts for VoIP service with a New York telephone number but answers the calls on the telephone with a VoIP terminal adapter located in the Los Angeles office.

This commercial advantage may become a 9-1-1 liability. Since the application is separate from the transmission facility, it is highly unlikely the VoIP service provider knows where its subscriber is using the service at a given time. Consequently, absent some automatic location determination technology, the subscriber must play an active role in identifying his or her location for accurate 9-1-1 call routing and ALI purposes. The problem is akin to Phase I or basic wireless 9-1-1 issues where a caller's location is not known with precision, if at all, unless the caller can provide it.

Another challenge to the current 9-1-1 interconnection model is the fact that VoIP service providers are not usually certified telecommunications utilities. Therefore, they have no rights to those 9-1-1 interconnections that are part of a standard ICA negotiated under the Telecommunications Act of 1996.[3] While ILEC attitudes toward this state of the law vary somewhat, most appear to be taking the position that, absent waiver, they are not required to offer carrier-type interconnection to non-carrier VOIP providers.

Even if non-carrier interconnection were possible, it is not always cost-effective. The current 9-1-1 interconnection model uses dedicated circuit-switched "trunk-side" (intra-PSTN) access to 9-1-1 tandems (or "selective routers"). This is predicated on the old presumption that the serving switch was most likely proximate to the selective routing switch. With its use of the open public internet or wide-area private intranet as a transport medium – VOIP certainly shatters that location-based presumption. Consequently, a small VoIP provider serving customers throughout the United States with a handful of diversely-located gateways might be economically hard-pressed to directly interconnect to the numerous 9-1-1 tandems throughout the country.[4]

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[3] Under Title II of the Communications Act, and parallel state law, interconnection requirements typically are imposed on telecommunications carriers for the benefit of other carriers. The assignment of telephone numbers under Part 52 of the FCC Rules, 47 C.F.R. Part 52, is for telecommunications carriers intending to provide telecommunications services. Recently, an SBC VOIP service affiliate was granted a waiver of Section 52.15(g) for the direct assignment of telephone numbers despite its non-carrier status. Order, FCC 05-20, released February 1, 2005. Other VOIP non-carrier providers are seeking similar waivers.

[4] These structural issues are elaborated in the attached slides from Roger Hixson of NENA describing I2 migratory options.

ENTERPRISE. VOIP service is widely used by businesses in lieu of traditional Private Branch Exchange ("PBX") telephone systems. These "soft switches" are marketed as offering lower cost and advanced features. Efficiencies in wiring the business premises, sharing data network hubs and routers, and the ability to use multimedia PCs to support video applications are typical objectives of buyers of these systems. The enterprise VoIP system is constructed using a private network that only transports voice and data communication packets of that corporate entity.[5]

It is easy to recognize the similarities of an enterprise VoIP system and a traditional PBX. The 9-1-1 issues are essentially the same with both. Long before the introduction of enterprise VoIP there were 9-1-1 issues with PBX systems that had off-premises extensions ("OPX") or were used to consolidate/centralize telephone services at multiple locations with different street addresses. For example, using one primary PBX switch at a school district administrative building with digital remote modules installed at individual school campuses has been a serious problem for 9-1-1 for years. The high-rise office building often presents the same difficulties in a vertical dimension. Enterprise VoIP simply makes it easier and less expensive for a multi-line telephone system ("MLTS") to have OPXs and serve multiple locations or floors through a centralized soft switch.[6]

MOBILE. A separate classification is also offered for the technological evolution where internet-based VoIP service can use wireless internet access. The development and deployment of wireless internet access will progress to the point that the mobility afforded to a VoIP service customer by wireless internet access will combine the relatively new 9-1-1 issues related to nomadic VoIP with ongoing 9-1-1 issues related to wireless telephone services.

The deployment of 3rd Generation ("3G") wireless networks and the recent FCC assignments and auctions of spectrum for both licensed and unlicensed wireless broadband applications will certainly usher in new wireless communications services based on IP technology. As with any mobile technology, whether it is circuit-switched or IP packet-based, the greatest challenge is to determine accurately and reliably the location of the 9-1-1 caller. Given that wireless carriers have already invested heavily in location based technologies to meet FCC wireless E9-1-1 mandates (and for commercial applications), it is logical to assume this investment will be leveraged in the deployment of IP-based wireless applications like wireless VoIP.

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[5] Separate classifications for nomadic and enterprise environments may be more a matter of taste than necessity. The frequent shifts of telephone points of use by employees within a large corporate space resemble the nomadic behavior discussed above.

[6] The MLTS 9-1-1 issue drew regulatory attention at the same time as wireless caller ANI and ALI began to be discussed, but progress toward a solution has languished by comparison. Questions of cost and administrative burden on small to middle-sized businesses, plus challenges to FCC jurisdiction over the workplace, have caused the FCC, for now, to leave the issue to the states, but the docket remains open on the subject. Public Notice, DA 04-3874, CC Docket No. 94-102, December 10, 2004.

How Much Choice?

There are numerous ways for IP-based service providers to connect, directly or indirectly, the existing 9-1-1 infrastructure for delivery of their customers' 9-1-1 calls to the native 9-1-1 network. There is no reason for the FCC or the interested parties to tolerate the continuation, much less expansion, of the practice of VOIP providers connecting to PSAPs administratively – outside the native network – with the consequent loss of ANI, ALI and selective routing.

In an ex parte communication in WC Docket 04-36 dated April 7, 2005, Vonage called for rules to prohibit PSAPs from blocking access to "administrative" (10-digit) numbers which receive calls outside the native 9-1-1 network. We believe that any VOI calls which must, for some very brief transitional period, be directed to PSAPs outside the 9-1-1 network should go only to numbers designated solely for emergency calls and staffed around the clock.

Increasingly, however, many VOIP providers are looking for cheaper and/or better ways to connect to the native 9-1-1 network than are offered by retail or wholesale purchases from ILECs or CLECs. The IP providers' discontents are evident in the comments and petitions in CC Docket No. 99-200 on direct number assignment. For their part, ILECs functioning as 9-1-1 system service providers ("SSPs") are reluctant to entertain new methods they view as unreliable.[7] We fear some of this reluctance arises from concern for the competitive threat posed by non-carrier providers who are mounting an early charge in a market the ILECs also wish to enter.

Several options for access to the native 9-1-1 network are discussed in the appended slides prepared by NENA's Technical Issues Director, Roger Hixson. We add by way of caution that the slides have not been reviewed yet by VOIP providers.

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[7] Letter of James C. Carroll, Qwest Public Safety Product Manager, dated April 11, 2005, to Jeffrey Citron of Vonage, regarding the so-called King County trials.

Options for VoIP to E9-1-1 pre-Migratory (I2)

Voice over Internet

Fixed and Nomadic users,
Including WiFi base station locations

Enterprise VoIP

Roger Hixson March 2005

Choices

- **Optimally, all investment toward improved E9-1-1 service access would be directed toward immediate completion of design, testing, and implementation of an IP-based Next Generation 9-1-1 capability, on a national scale.**
- **In reality, even on a best effort basis, the above is a 3 to X years effort.**
- **In actuality, an intermediate transitional approach is needed. NENA has designed such a method, the Migratory (I2) definition.**
- **Subsets of this approach can be implemented rapidly, with the correct national investment and willpower to fast track the work.**
- **A meaningful business case environment is essential to progress nationally**

For completeness, we need to look at the CLEC-like methods (indirect access) and four possible variations for direct VoIP access to current E9-1-1 systems, and at both voice and data issues.

For purposes of illustration, following numerical estimates are based on:

- **Each VoIP provider has a single IP router nationally?**

  (actually probably a minimum of 2 or 3?)

- **500 Selective Routers nationally**

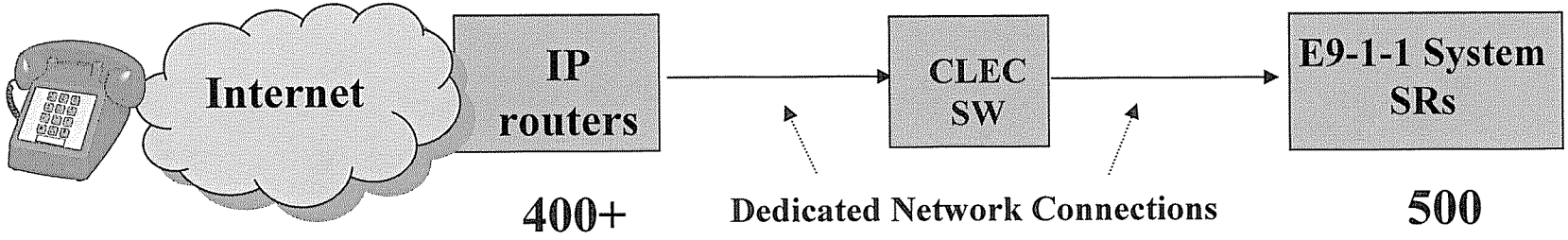
  - estimates vary between 440 (SWAT) – 750 (?)

- **ESGW count based on two per state**

- **There are a relatively small quantity of PSAPs that have no connections to Selective Routers, such as in Basic 9-1-1 arrangements**

CLEC Option for VoIP indirect to E9-1-1

Service Provider IP Router to E9-1-1 SR via dedicated trunking through CLEC switches



Characteristics:

- All VoIP service providers must have national access
- $ - relatively high cost per subscriber, long inter-state trunk runs
- IP router to CLEC switch can be in CLEC internal networks, rather than in the general IXC environment. CLEC switch to SR is often intra-state
- Reliability – High after the Internet segment
- Precedent impact– expansion of traditional E9-1-1 structure

CLEC Option for VoIP indirect to E9-1-1

Service Provider IP Router to E9-1-1 SR via dedicated trunking through CLEC switches

Considerations:

- Call path suitable for primary, high volume calling, with automatic delivery
- Implementation – medium complexity
- Continuous churn in trunk groups – as service providers come and go, each could change 500 TGs (one for each SR)
- Inefficient use of network resources?
- Inconsistent with proposed Future Path to I2

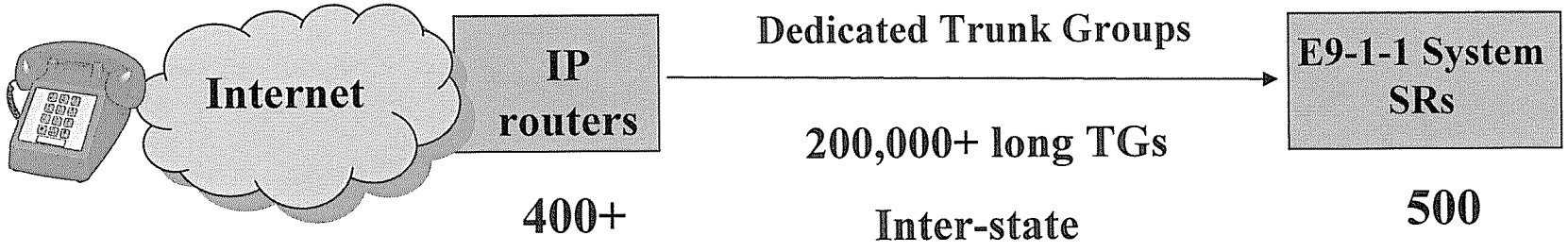
Status:

- Being used for VoIP service environment
- Costs considered high by Vol providers, esp by new entrants

The following slides speak to direct VoIP provider access options

Option A for VoIP to E9-1-1 pre-Migratory (I2)

Service Provider IP Router to E9-1-1 SR via dedicated trunking across public telephone network



Characteristics:

- All VoIP service providers must have national access
- $ - high cost, long inter-state trunk runs
- Reliability – High after the Internet segment
- Precedent impact– traditional E9-1-1 structure

Option A for VoIP to E9-1-1 pre-Migratory (I2)

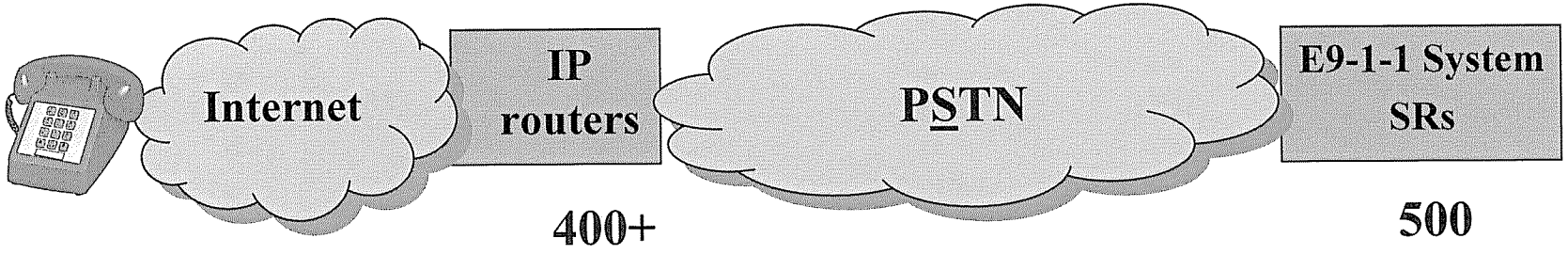
Service Provider IP Router to E9-1-1 SR via dedicated trunking across public telephone network

Considerations:

- Call path suitable for primary, high volume calling, with automatic delivery
- Implementation – medium complexity
- Continuous churn in trunk groups – as service providers come and go, each would change 500 TGs (one to each SR)
- Inconsistent with Future Path to I2
- Not realistic for VoIP service environment?
- Too costly, too complex?
- BUT can be useful for small regional applications

Option B for VoIP to E9-1-1 pre-Migratory (I2)

Service Provider IP Router to E9-1-1 SR via switched connection through general PSTN



Characteristics:

- All VoIP service providers must have national access
- $ - medium cost, medium to heavy switch translations
- Reliability – acceptable if human control of call advance
- Precedent – negative for other service types, would require specific exclusions re CLECs and WLS carriers

Option B for VoIP to E9-1-1 pre-Migratory (I2)

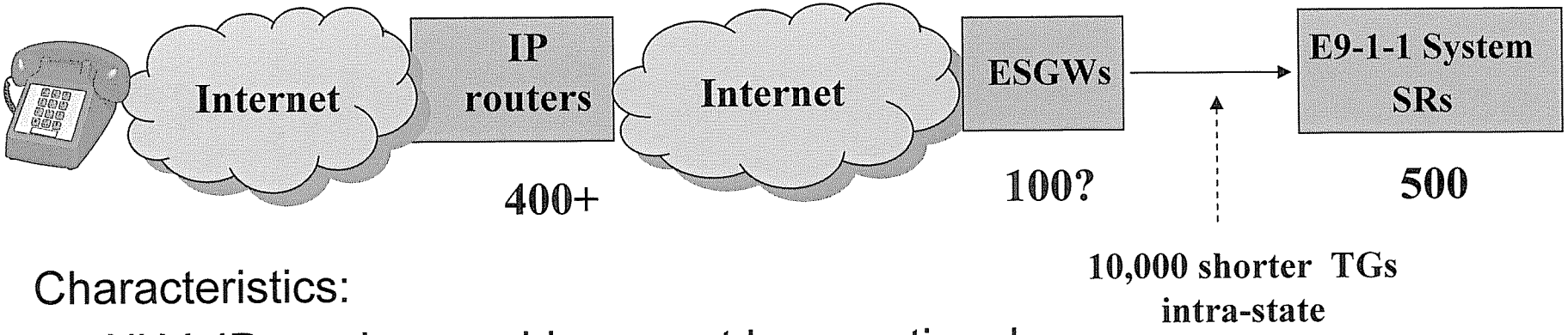
Service Provider IP Router to E9-1-1 SR via switched connection through general PSTN

Considerations:

- Call path suitable for low volume calling with human control to deal with possible call blockages and delivery assurance
- Implementation - medium complexity
- Difficult to administer network capacity
- Could be accomplished in reasonable timeframe
- Several negatives identified in Qwest/King County, WA trial
- Direct dialable numbers may be an inappropriate option?
- Use of routable but non-dialable numbers for SR access can avoid some negatives, but requires access numbers to be in the LERG (local exchange routing guide) for routing control
- Inconsistent with Future Path to I2

Option C for VoIP to E9-1-1 pre-Migratory (I2)

Service Provider IP Routers through Internet to ESGWs with dedicated trunking to E9-1-1 SRs



Characteristics:

- All VoIP service providers must have national access
- $ - medium cost, in-state trunk runs
- Reliability – High after the Internet segment
- Gateways would be accessed using IP addresses
- Call and callback number would be passed to SR on dedicated trunking

Option C for VoIP to E9-1-1 pre-Migratory (I2)

Service Provider IP Routers through Internet to ESGWs with dedicated trunking to E9-1-1 SRs

Considerations:

- Call path suitable for primary, high volume calling, with automatic delivery
- Implementation - medium low complexity
- SSP ILEC's IP Routers could be configured and partitioned to serve as the E9-1-1 gateways? saving time and money?
- Can be accomplished in reasonable timeframe if national focus applied on common solution and enabling factors resolution
- Positive precedent - Consistent with Future Path to I2
- Exact national layout depends on both cost balance and infrastructure relationships

Option C for VoIP to E9-1-1 pre-Migratory (I2)

Service Provider IP Routers through Internet to ESGWs with dedicated trunking to E9-1-1 SRs

Who would provide ES Gateways?

1. **VoIP providers**
   - **same negatives as Option A – no !**
2. **Multiple competitive 3rd parties – maybe**
   - **indeterminate timeframes**
   - **no one may be interested? Cost vs profit?**
   - **may be no focal point for rapid implementation**
3. **SSPs**
   - **limited quantity of SSPs (15-30 companies?)**
   - **focal point for implementation**
   - **experienced in E9-1-1 design and administration**

Timeframes to accomplish can be accelerated with federal/state cooperative program

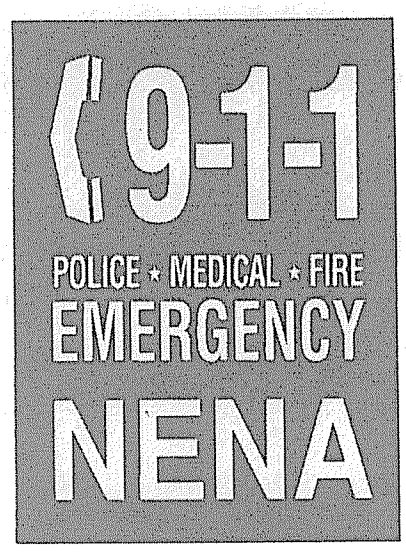
VoIP to E9-1-1 pre-Migratory (I2)

The rest of the story – ALI database update

(below is very general)

- Use whatever level of Migratory design is needed
- CLEC-like DB update processes would support all local NNX fixed and nomadic cases (customer reported location)
  - transaction/update transmission using NENA data exchange standards – direct or via national vendor
  - Must be timely – within hours of user location update
  - `PS ALI' approach could be used (but undesirable limits)
- Either ESQK* approach, or NPA-911-PSAP structure as interim routing/query (number)

*emergency service query key



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